

THE VIR PROCESSING SYSTEM

The program as revised to 1 September 1966

APPENDIX II
to Letter Report on
NASA Grant NGR 47-005-036

Prepared by
R. L. Tomlin, Jr.

FACILITY FORM 802	N66-87337	
	(ACCESSION NUMBER)	(THRU)
	26	None
	(PAGES)	(CODE)
	CR-78329	
	(NASA CR OR TMX OR AD NUMBER)	(CATEGORY)

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Report No. UVAL-4031-102-66U
September 1966

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I. INTRODUCTION

One of the activities engaged in by members of the staff of the Alderman Library at the University of Virginia is the creation of document reference material which is punched onto eight-channel paper tape. On the paper tape (which is created by simultaneously typing and punching on a Friden Flexowriter), each document reference is regarded as constituting a single record of information. Hereinafter, any such record will be referred to as a Virginia Input Record (VIR), and this usage will be extended to apply as well to punched card and magnetic tape images of such records.

The existence of information on punched paper tape implies the ability to engage in machine (digital computer) handling operations, and it is the intention of the present document to describe the structure of a system designed to effect two such operations.

These operations are:

- (1) The maintenance of a master file of all flaw-free VIRS which have been produced to a given date.
- (2) The creation of files whose records are document references based upon the master file of VIRS, and whose formats are compatible with the NASA 1401 and the 1410 Linear Files (i. e. , two files must be created).

The system of digital computer programs designed to achieve the objectives (1) and (2), above, is called The VIR Processing System, and it has been implemented on the Burroughs B-5500 Data Processing System by members of the Theoretical Analysis Division of the Research Laboratories for the Engineering Sciences (RLES) at the University of Virginia. In the development which follows, the several computer programs of interest will be described separately, but in an order which is natural and appropriate to the discussion as a whole. Following this,

there will be a section of text which is devoted to displaying the file structure and record formats for the major files of interest. It is this latter section which will conclude the document.

II. THE READFIX PROGRAM

(II. 1) Nature of the VIRS

The VIR is a reasonably complex entity, not only because of the variety of items of information which may be present (and optionally absent) therein, but also because of the free-field type of format involved. The reasons for the numerous and frequently optional items of data are to be found in an examination of the variety of documents to be referenced by VIRS.

The free form used is intended to make the typed copy which is produced at the time of punching serve as a visual record of what was done, and also as hard copy which is directly intelligible to the human reader.

(II. 2) The Need for Structural Correctness

It is evident that the free-form requirements imposed on the structure of a VIR, however flexible they may be, must be strictly upheld if machine access and retrieval of embedded information is desired. Certainly the machine creation of a NASA Linear File Record from a VIR demands this.

The need clearly implied here, of course, is that of a facility for checking to see if the necessary flags and basic content of a VIR are correct. Also of direct interest is a mechanism for altering a VIR if it fails to meet the necessary requirements.

(II. 3) The Decision for READFIX

The work of diagnosing and patching the defects of VIRS is so different from the considerations involved in creating and updating a

master file of them that two programs are required. It is the former activity which is handled by the program, READFIX.

In its first contact with a VIR, READFIX may be used to produce a printed listing or a magnetic tape image thereof. The magnetic tape files used by READFIX are regarded as temporary files for the storage of VIRS, and they are designed for ease and clarity in regard to manipulation and restructuring. The reels containing such files are called partial reels, and the files themselves are called partial reel files (PRF's).

VIRS are normally grouped together in batches of three or four dozen, and each such batch occupies a separate paper tape. When submitted to READFIX, a batch is carried directly to magnetic tape as a PRF, and thereafter it is operated on by reading and updating that magnetic tape.

(II. 4) Summary of READFIX

Briefly stated, READFIX is a program which provides temporary magnetic tape storage, diagnostic checks, and patching facilities for VIRS. In this connection, every effort has been made to provide powerful features which may be controlled with great ease by the human user of the program. This attempt to accommodate the interests of the human user is simply an extension of the philosophy involved in the use of free-field format for the VIR itself.

READFIX is also used in conjunction with the master file maintenance program, DOVTAPE, to achieve master file patching. Additionally, the PRF's are used as a basic source of records for the master file creation process.

For a complete discussion of the features and use of READFIX, the document, A Guide to READFIX, should be consulted. For the formats of PRF's and other files, see the relevant section later in this document.

III. THE DOVTAPE PROGRAM

(III. 1) The Main Concerns

The two most prominent objectives sought in connection with the master file of VIRS are compactness in space requirements on the magnetic tape, and the keeping of records as to the history of the VIRS present in the file. These are provided for structurally by the choice of an efficient formatting and blocking arrangement for the magnetic tape, and also by the inclusion of a segment of "historical" information with each VIR entered in the file.

(III. 2) Summary of DOVTAPE

DOVTAPE serves as the master file maintenance program for VIRS. As in the case of READFIX, every reasonable effort has been made to tailor the features and the control of DOVTAPE to the needs of the human user.

Operationally, DOVTAPE uses partial reel files (PRF's) as input whenever VIRS are being added to (or replaced on) the master file. The master file itself is called VIRTAPE, and it is normally used as input to DOVTAPE whenever copying or dumping operations are desired.

The structure and format of VIRTAPE are described later in this document, and a complete description of the DOVTAPE program is available in the document, A Guide to DOVTAPE.

IV. THE MAKNASA PROGRAM

(IV. 1) The NASA Tape Requirements

What has been referred to as objective (2) in the introduction, above, implies the need to be able to produce NASA Linear File reels using VIRS as input. This facility is present in the VIR Processing System in the form of a program called MAKNASA.

The design of the MAKNASA program is such that almost any interesting combination of sources for input records may be considered. In particular, it is possible to produce a 1401 reel from a 1410 reel, and conversely, as well as to construct either 1401 or 1410 records directly from VIRS. Further, the standard error dumping and file control features needed for large file maintenance are present.

(IV. 2) Summary of MAKNASA

The MAKNASA program is a complete file maintenance system for NASA Linear Files. It provides the normal copying, updating, and dumping features which are commonly present in such a facility, and it also achieves automatic creation of Linear File Records by using VIRS as input. As ever, the design of the program is such as to ease the burden of the human user wherever possible. Complete details for MAKNASA are given in the document, A Guide to MAKNASA.

V. FILE STRUCTURE AND RECORD FORMATS

(V. 1) Partial Reels

General Remarks

One recalls that the PARTIAL reels are multi-file reels with multi-file ID equal to "PARTIAL", and that they may be used as input for the programs, READFIX, DOVTAPE, and MAKNASA.

The PARTIAL reels are created and maintained by the program, READFIX. Each file on a PARTIAL reel consists of a batch of Virginia Input Records (VIRS), and, accordingly, such files will often be referred to as batches. Further, each batch will have a batch identification (Batch ID) consisting of seven or fewer BCL characters, and the corresponding file on a PARTIAL reel will have file identification part (FID) equal to this Batch ID, left justified if necessary.

All PARTIAL reels are written in binary mode at high density (556 b. p. i.). They are Algol blocked with fourteen (14) card images

per block, i. e. , they have BUFFER SIZE = 155 words and MAXIMUM LOGICAL RECORD LENGTH (MRL) equal to 10 words. This choice results in approximately 75% effective use of space on the tape, and it yields spacing times which are 2/3 those for tape blocked five card images per block.

Size of VIRS and Files on PARTIAL Reels

One anticipates that the average VIR will consist of approximately twenty lines (including empty lines) with an average of 48 characters per line, i. e. , 960 characters.

The maximum size VIR may have 99 lines and 3000 characters (375 words).

The maximum number of VIRS in a batch is ninty-nine (99). The minimum number is one.

Layout of the Records in a PARTIAL Reel File

Every file on a PARTIAL reel contains a batch of VIRS, plus certain information about those VIRS. Altogether, there is enough information to describe dates of creation, updating, and current writing for all VIRS present.

Schematic of a Partial Reel File

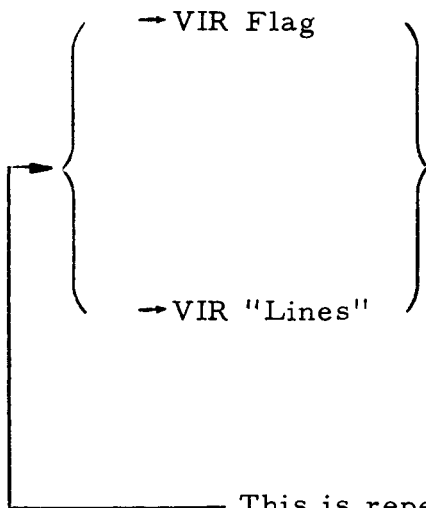
<u>Record(s)</u>	<u>Remarks</u>
→ Batch Flag	This is a ten-word record which identifies the batch and displays creation and current version dates.
→ Directory Header	This is a ten-word record giving the number of entries in the <u>batch directory</u> , and the accession numbers of the first and last entries.

Record(s)

Remarks

→ Batch Directory

This is a collection of ten-word records called directory segments. Each segment contains five entries. The number of segments depends on the number of entries.



This ten-word record precedes each VIR in the batch. It describes the VIR which it precedes, in the sense of accession number and dates of creation and updating.

These are records of one-to-ten words which give characters of the VIR itself.

Record Descriptions (Formats)

(A) The BATCH FLAG

This is a ten-word record with the following format:

BATCH FLAG Format

Characters

Remarks

1 - 11

Contain the string, "Batch①ID①=①".

12 - 18

Contain the Batch ID, left justified with blank trailer.

<u>Characters</u>	<u>Remarks</u>
19 - 40	Contain the string, ". ①①ORIGINALLY①WRITTEN①".
41 - 48	Contain the <u>date of creation of</u> <u>this batch</u> , in the form, MM-DD-YY.
49 - 71	Contain the string, ". ①THIS①VERSION①WRITTEN①".
72 - 79	<u>Date of writing of this version of</u> this batch.
80 - 80	Contain the string ". "

(B) The DIRECTORY HEADER

This is a ten-word record with the following format:

DIRECTORY HEADER Format

<u>Characters</u>	<u>Contents</u>
1 - 17	"THE①DIRECTORY①OF①"
18 - 24	The <u>Batch ID</u> , left-justified with trailing blanks.
25 - 29	"①HAS①"
30 - 31	A Two-BCL-digit integer equal to the number of entries in directory.

CharactersContents

32 - 41

"①ENTRIES.①"

42 - 49

Accession number of the first entry,
in the form, YYVXXXXX.

50 - 64

"①IS①FIRST,①AND①"

65 - 72

Accession number of the last entry.

73 - 80

"①IS①LAST"

(C) The BATCH DIRECTORY

The directory contains an entry for each VIR in the batch. This entry defines the correspondence between the relative position (first, second, etc.) of the VIR and the accession number of the VIR.

The records of the directory are ten-word segments, each of which contains five entries. The number of segments, then, is always \leq twenty.

Directory Segment Format

CharactersContents

1 - 5

"①VIR①"

6 - 7

Two BCL digits giving the position
of the VIR, being 01 for the first, etc.

8 - 8

" = "

9 - 16

Accession number of the VIR, YYVXXXXX.

This is repeated four more times to fill out the segment. Blank trailer is used if there are no more entries.

(D) The VIR FLAG

This ten-word record describes the VIR which it precedes.
It has the format:

VIR FLAG Format

<u>Characters</u>	<u>Contents</u>
1 - 3	"VIR"
4 - 5	Two-BCL-digit integer giving the <u>position of the VIR.</u>
6 - 13	"FLG①VIR①"
14 - 15	Same as 4-5, above.
16 - 36	", ①ACCESSION①NUMBER①=①"
37 - 44	The <u>accession number</u> of the VIR, YYVXXXXX.
45 - 54	"; ①CREATED①"
55 - 62	Date of <u>CREATION</u> of the VIR, MM-DD-YY.
63 - 72	"; ①UPDATED①"
73 - 80	Date of most recent updating of the VIR, MM-DD-YY. ("NOTATALL" if never updated.)

(E) The VIR "LINES"

The actual characters of each VIR in a batch are supplied in records called "lines". These are variable in length, being from two to ten words long, with blank filler to the right if the number of characters supplied is not zero modulo eight.

For any given VIR, at most ninety-nine lines will be permitted.

"LINE" Format

<u>Characters</u>	<u>Contents</u>
1 - 3	"VIR"
4 - 5	Two-BCL-digit integer equal to the <u>position of the VIR</u> in the batch.
6 - 6	"L"
7 - 8	Two-BCL-digit integer equal to the <u>number of this line</u> (01 for first, etc.).
9 - XX	Where XX is zero MOD 8 and ≤ 80 , these are VIR characters, the last word featuring blank filler if necessary.

Summary of PARTIAL Reel Discussion

As can be seen from the structure given above, any file on a PARTIAL reel is a batch of VIRS which, once assembled, never loses its integrity. Such a file can be copied and updated within the VIRS, but none of the VIRS may be removed, and none can be added. The directory, then, is permanent.

The date of original writing shows the time of assembly of the file, and the current date is inserted as the date this version was written whenever the file is copied and/ or updated. Each VIR in the file also contains the creation date, plus the date of the most recent updating of that VIR.

(V. 2) Patcher

General Remarks

An optional input file used only by READFIX, PATCHER is the card-reader file which contains patch cards whenever a file on a PARTIAL reel is being updated. Patch records for any number of such files may be supplied. The patching is done on a line-by-line basis as can be seen in detail later in this section. This includes the ability to insert as many as nine (9) additional lines between existing lines, and to delete lines, if desired.

Layout of the Records in PATCHER

PATCHER contains, in general, a parcel of records for each file being updated, and these parcels must appear in the order in which they are to be used. Schematically, this is:

<u>Record(s)</u>	<u>Contents</u>
Label	Label Record with FID="PATCHER"
First Parcel	Parcel for first batch being updated
.	.
.	.
.	.
Last Parcel	Parcel for last batch being updated
End-of-Deck	End-of-Deck card.

The structure of a parcel is as follows:

<u>Record(s)</u>	<u>Contents</u>
→ Patch Header	A ten-word record which displays the Batch ID for the file to be updated using this parcel.
→ Patch Cards	These are records which are either to replace "lines" in an existing VIR or to be inserted between existing lines or to cause deletion of existing lines.

The formats are:

PATCH HEADER Format

<u>Characters</u>	<u>Contents</u>
1 - 32	"PARCEL①OF①PATCH①CARDS①FOR①BATCH①"
33 - 39	The ID for the batch (file) being updated, left-justified with trailing blanks.
40 - 40	". "
41 - 80	Ignored by READFIX.

PATCH CARD Format

Characters

Contents

1 - 3

"VIR"

4 - 5

Two-BCL-digit integer giving the position of the VIR to be updated using this card.

6 - 8

Either "FLG", or the form IYY, where I is the insertion level character, and YY is a two-BCL-digit line number.

If "FLG" is used, then the card must, thru column 44, have the same form as the VIR FLAG (see above under PARTIAL Reels), and the accession number given here will replace that on tape.

If the form, IYY, is used, then either I = blank or I = one of the letters A, B, ..., I, or X. In the case of I = blank, this card replaces the one on tape whose line number is the same, i. e., whose line number = YY.

If I = X, then line YY on tape will be deleted.

If I = {one of the letters A thru I}, then this card will be added to the VIR on tape, being inserted after the card with line number equal to YY. [Note: The insertion level character must proceed in order, from A upwards, if several lines are to be added.] The remainder of the description here is for the case I ≠ blank or X.

Characters

9 - XX

Contents

Where XX is zero MOD 8 and $XX \leq 80$, these are the characters which will replace (or be added to) those already on tape. The last word used will be the first one which contains a group mark (\leftarrow , i. e., C/R), or the last on the card, whichever comes first.

Summary of the Patch Card Facility

Using records placed in the file, PATCHER, any number of files (batches) on PARTIAL reels may be updated. The update functions permitted are:

- Changing of the accession number of VIRS.
 - Replacement of "lines" within VIRS.
 - Addition of as many as nine (9) "lines" following any "line" already in a VIR.
 - Deletion of "lines" within VIRS.
- Note that it is not possible to alter the creation date for a VIR on tape.

(V.3) CARDVIR

General Remarks

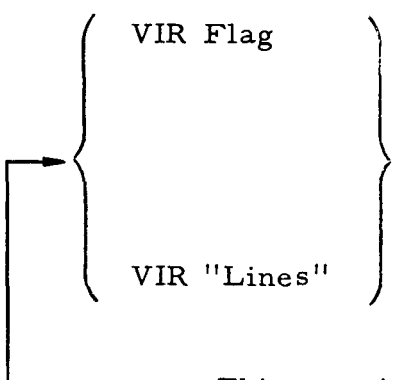
Card-image VIRS may be submitted to READFIX via the optional card reader file, CARDVIR. It is possible to supply any number of batches (or batch portions) as records of CARDVIR. It is, of course, necessary for the ordering of such information within CARDVIR to coincide with the order in which it will be used.

In general, a batch can be written on a PARTIAL reel using VIRS from PAPRVIR alone, CARDVIR alone, or from both, placing either one first on tape.

The crude schematic form of CARDVIR is:

<u>Record(s)</u>	<u>Remarks</u>
Label	Label Record with FID="CARDVIR"
First Portion	The first batch portion to be used.
.	.
.	.
.	.
Last Portion	The last batch portion to be used.
End-of-Deck	End-of-Deck card.

The portions of batches are structured as follows:

<u>Record(s)</u>	<u>Remarks</u>
Portion Header	This is a single record which specifies the Batch ID of the batch which is to contain the cards which follow.
	This defines the beginning of a VIR in this portion. This single record serves to supply the accession number of that VIR, also.
	These are CARDVIR records which supply the characters of a VIR.

This part is repeated for each VIR supplied in this portion.

Record Formats

(A) Portion Header

This record defines the start of a portion of a batch in the file, CARDVIR.

Portion Header Format

<u>Characters</u>	<u>Contents</u>
1 - 30	"PORTION①OF①THE①VIRS①FOR①BATCH①"
31 - 37	The Batch ID of the batch which is to receive the VIRS in this portion, left-justified with trailing blanks.
38 - 38	". "
39 - 80	Ignored by READFIX.

(B) VIR Flag

This record is essentially identical to that described under PARTIAL Reels, above, except that the only fields which will be scanned are columns 6-8, which must equal "FLG", and columns 37-44, which will be used as the accession number.

(C) VIR "Lines"

These are essentially identical to the "lines" described under Partial Reels, above, except that the only requirement on columns 1-7 of a "line" is that they not equal "PORTION", and columns 6-8 must not equal "FLG".

The rules for which words will be used from columns 9-XX are the same as described for Patch Cards, above.

Summary for CARDVIR

CARDVIR may be used by itself, or in conjunction with PAPRVIR, to create arbitrarily many batches (files on PARTIAL Reels).

Aside from the flagging records which separate batches and VIRS, the records used have essentially the same format as the "lines" on PARTIAL reels, except that little is required with respect to columns 1-8.

(V. 4) PNCHVIR

This is the optional card punch file for READFIX which is used to dump VIRS from files on PARTIAL Reels. Whenever such dumps are invoked, only VIR Flag records and "line" records will be punched. These will be straight, unedited dumps.

(V. 5) VIRTAPE

General Remarks

VIRTAPE is the master magnetic tape file (multi-reel) which contains the VIRS in permanent, final form. Each logical record of VIRTAPE contains one VIR.

VIRTAPE is written in binary mode at high density (556 b. p. i.). The buffer size is 510 words, and the MRL=392 words. Here, tight Algol blocking will be used, i. e. , the maximum number of logical records will be placed into each block which is written.

This gives approximately 90% effective use of the space on tape, and, this being the case, at least six (6) average VIRS per foot of tape.

Record Layout

Each logical record of VIRTAPE consists of three parts:

VIRTAPE Record Format

<u>Word(s)</u>	<u>Contents</u>
1	The number of this record, supplied as an 8-BCL-digit integer. (Record numbers begin with 00000001.)
2 - 16	Source Key - This 15-word portion describes the history of the VIR contained in this record of VIRTAPE (see below).
17 - XX	This is the VIR itself, exactly as it appears on paper tape (when correctly punched), with upper case-lower case characters, etc. Always, $XX \leq 391$ (3000 characters maximum in the VIR), and the last word will have blank filler to the right, if necessary.
XX + 1	Check sum information.

Source Key Format

<u>Characters</u>	<u>Contents</u>
1 - 8	The accession number of the VIR in this record, in the form YYVXXXXX.
9 - 21	"①WAS①CREATED①"

Characters

Contents

22 - 29

The creation date of the VIR, in the form MM-DD-YY.

30 - 39

",①UPDATED①"

40 - 47

The most recent date of updating for the VIR, MM-DD-YY.

48 - 68

",①AND①PUT①ON①VIRTAPE①"

69 - 76

The date this VIR was written on VIRTAPE, in MM-DD-YY form.

77 - 86

"①FROM①THE①"

87 - 94

The date of writing of the version of the last batch which contained this VIR before it reached VIRTAPE.

95 - 112

"①VERSION①OF①BATCH①"

113 - 119

The Batch ID of the last batch to contain this VIR before it was copied to VIRTAPE. This must be left-justified with trailing blanks.

120 - 120

". "

Summary of VIRTAPE

VIRTAPE is heavily blocked, and all logical records contain a VIR, plus a record of the history of its handling, plus the number of the record within VIRTAPE, plus check sum information.

REFERENCES

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2. Tomlin, R. L., Jr., "A Guide to READFIX," Appendix III to Letter Report on NASA Grant NGR 47-005-036, University of Virginia Library, Charlottesville, Report No. UVAL-4031-103-66U; September 1966.
3. Tomlin, R. L., Jr., "A Guide to DOVTAPE," Appendix IV to Letter Report on NASA Grant NGR 47-005-036, University of Virginia Library, Charlottesville, Report No. UVAL-4031-104-66U; September 1966.
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